REMARKS

Claims 1-3 and 6-12 are pending. By this Amendment, claim 7 is amended. Support for the amendments to claim 7 can be found on page 56, lines 2-14 and Figs. 8A-10, for example.

Entry of the Amendment is proper under 37 CFR §1.116 since the Amendment: (a) places the application in condition for allowance for the reasons discussed herein; (b) does not raise any new issues requiring further search and/or consideration; (c) does not add any additional claims; and (d) places the application in better form for appeal, should an appeal be necessary. Entry of the Amendment is thus respectfully requested.

A Restriction and an Election Species Requirement was asserted and Applicants elected Group I and Fig. 9. Claims 1-3 and 7-12 read on the elected group and species. Applicants request rejoinder of claim 6 when claim 1 is allowed because claim 1 remains generic to claim 6.

The Office Action requests another certified copy of Japanese Patent Application No. 2004-028470, filed February 4, 2004, even though the July 6, 2004 date stamped receipt indicates that it was filed. Applicants request that the Examiner acknowledge receipt based on the enclosed first two pages of the certified copy and the July 6, 2004 date stamped receipt indicating filing of the certified copy. With these documents, the Examiner can acknowledge that the certified copy was received even though the certified copy cannot be located through the fault of the Patent Office. It is not necessary for Applicants to submit a second certified copy when Applicants can show that the first copy was filed with the Patent Office.

A substitute Declaration will be filed shortly in response to the objection to the Declaration. Applicants appreciate the Examiner's patience.

Claims 1-3 were rejected under 35 U.S.C. §103(a) over JP-A-9-097637 (JP '637) and Kimura et al. (Kimura), U.S. Patent No. 5,786,304, and claims 7-12 were rejected under

35 U.S.C. §103(a) over JP '637 in view of Sakuraba et al. (Sakuraba), U.S. Patent No. 5,623,240. The rejections are respectfully traversed.

JP '637 and Kimura fail to disclose or suggest an oxide superconductor current lead in which metallic electrodes are provided at both sides of a rare-earth based oxide superconductor manufactured by a melting method, joining metal is provided at joint portions formed by the oxide superconductor and the metallic electrodes, and the oxide superconductor and the metallic electrodes are joined by the joining metal, wherein a volume of holes in the joining metal provided at the joint portions is 5% or less of a volumetric capacity of the joint portions, as recited in claim 1.

Page 4, lines 1-6 of the Final Office Action states that JP '637 realizes a low contact resistance in the joint portions and that holes formed by the entrapped gas at the joint will increase the resistance. The Final Office Action then concludes by stating that it can be suggested that there will be a minimum amount of entrapment of the gas in the joint portions of JP '637. Applicants disagree with this analysis.

According to JP '637, the holes formed in the joint portions are not taken into consideration, and a problem during feeding of a large current involved in using a rare-earth based oxide superconductor manufactured by a melting method is not taken into consideration. Therefore, the features recited in claim 1 are not obvious over JP '637. An explanation will be again given.

The Applicants explained in the previous argument that the resistance value varies depending on a measuring method, and therefore if the present invention and JP '637 are compared, such a measuring method of the resistance value needs to be studied.

According to claim 1, by using a rare-earth based oxide superconductor manufactured by a melting method as an oxide superconductor, a current of 1,000 A or more is actually flown to the joint portions and the resistance value is measured. Meanwhile, according to JP

'637, Bi2212 manufactured by a CO_2 laser melting method is used as the oxide superconductor, and therefore an energizing current capacity at the time of measuring the resistance value is estimated to be about 200A.

Here, Applicants measured the resistance value by feeding the current of 1000A to the joint portions (namely, joint portions that have not undergone defoaming treatment) formed with the holes, by using the rare-earth based oxide superconductor manufactured by a melting method as the superconductor.

The data thus obtained was plotted in a quadrangle and connected by a gray line in a graph in which a voltage is taken on the vertical axis and a current is taken on the horizontal axis. In this graph, by Ohm's law (R = E/I), the tilt of plotted dots shows a resistance value. A measurement result reveals that when the current is 500A or less, which flows to the joint portions formed with holes, the resistance value is 0.18 μΩ (namely, so-called "Ohmic quality" is satisfied heretofore). However, when the current exceeds 500A, the resistance value starts to increase accordingly (namely, so-called "Ohmic quality" is not satisfied), and the resistance value shows 0.232 μΩ at a current of 750A.

As is shown in this data, characteristic evaluation of JP '637 using Bi2212 reveals that when the energizing current is about 200A, the resistance value shows a sufficiently low value, even if not considering the holes formed in the joint portions.

Meanwhile, if a high current such as 1000A is flown to the joint portions formed with holes, the resistance value exceeds 0.232 μΩ at the time point of 750A, and therefore a measurement itself is impossible due to Joule heat generated in these portions.

Next, Applicants measured similar data, with regard to the resistance value which is obtained when the current of 1000A or more is flown to the joint portions (namely, the joint portions that have undergone the defoaming treatment) and when the current of about 200A is flown thereto, with the volume of the holes set as 5% or less of the volume of the joint

portions. The data thus obtained is plotted in a lozenge shape and connected by black line in the graph.

In this case, even if the energizing current exceeds 1000A, the resistance value stays at 0.18 μΩ (namely, so-called "Ohmic quality" is satisfied), and it is found that the resistance value is sufficiently low value.

Here, it appears that JP '637 does not focus its attention on forming the holes of the joint portions and does not perform processing of setting the holes as 5% or less of the volume of the joint portions as recited in claim 1, from the following viewpoints:

(1) The presence/absence of the holes formed in the joint portions has no influence on the resistance value of the joint portions, in the energizing current of JP '637;

(2) JP '637 has no description of forming the holes of the joint portions and as a matter of course, has no description of the defoaming treatment.

This is because Applicants first reveal that the holes are present in the joint portions and the presence of the holes allows the resistance value of the joint portions to increase, by using a rare-earth based oxide superconductor manufactured by a melting method as an oxide superconductor as recited in claim 1, and allowing a current of 1,000A or more to be flown to the joint portions.

Namely, as is described in the argument previously filed, when a large current is flown to the joint portions by using a Y123-based molten material as a superconductor, heat generation occurs at the joint portions, and therefore a contact resistance value at an interface between the oxide superconductor and a metallic electrode is measured in detail, and the interface between the oxide superconductor and the metallic electrode is decomposed and studied in detail over the entire surface, and as a result, it is found for the first time that there are holes in a joint metal of the interface between the oxide superconductor and the metallic electrode, wherein a volume of holes in the joining metal provided at the joint portions is

30% or more of a volumetric capacity of the joint portions. Further, by the present invention for the first time, the heat generation can be suppressed, even when a large current is fed through the joint portions, by forming the holes in the metal for joining, with its volume set at 5% or less of the joint portions. (see page 8, lines 8-20 of Applicants' specification, for example)

Meanwhile, according to JP '637, the holes formed in the joint portions are not required to be taken into consideration. Accordingly, as is specified by the Office Action, it appears that there is no description about the holes formed in the joint portions in JP '637. As is thus clarified, all of the features recited in claim 1 are not obvious over JP '637 wherein the holes formed in the joint portions are not taken into consideration.

Page 3, lines 10-14 of the Office Action states that FIGS.1 to 3 of Maeda discloses joining of a current lead made of rare-earth oxide superconductor with a normal conductor made of silver with low resistance, and Kimura discloses various embodiments of joining rare-earth based superconductor with solder comprising silver.

However, Maeda discloses the invention of controlling a state of an interface between the oxide superconductor and a silver electrode. Namely, according to Maeda, a structure of the holes formed in the joint portions, with the volume of the holes set as 5% of the volume of the joint portions is not taken into consideration. In addition, Maeda has no concept of having the joint portions.

Next, Kimura discloses various embodiments of joining a rare-earth based superconductor with solder comprising silver. However, the solder comprising silver disclosed in Kimura is not a metallic solder, but a silver comprising an oxide superconductor. Namely, the disclosure of Kimura suggests that oxide superconductors are joined by using the silver comprising oxide superconductor as solder. This is a completely different invention

from the current lead of the present invention for joining the oxide superconductor and the metallic electrode with low resistance.

In summary JP '637 fails to disclose or suggest all of the features recited in claim 1. Also, the features of claims 1 are directed to a completely different invention from Maeda and Kimura. Accordingly, none of the applied references disclose or suggest all of the features recited in claim 1.

None of the applied references disclose or suggest that in at least one of the metallic electrodes, a rod-shaped oxide superconductor placed in a metallic electrode to be substantially in parallel with an interface between the metallic electrode and the mating conductor, the metallic electrodes and the mating conductors are disposed so as to be overlapped on each other, and a surface area of this overlapped part is larger than a sum of sectional areas of the metallic electrodes and sectional areas of the mating conductors, as recited in claim 7.

According to the features recited in claim 7, a potential difference along a joint interface between the metallic electrodes and the mating conductors is prevented from being higher, even if a large current such as 1000A is flown to this current lead. Thus, the potential difference is prevented from being higher, generation of a drift current is prevented, which is a current flowing in a deviated manner to a part, where the current flows easily, in the interface between the metallic electrodes and the metallic conductors, and a contact resistance is reduced between the metallic electrodes that performs transfer of currents with the mating conductors.

Meanwhile, as pointed out in the Office Action, JP '637 neither describes nor suggests a method of joining with the mating metallic conductors.

In FIG.11 of Sakuraba, a first metallic electrode 122, a current lead bulk 120, and a second electrode 124 are only connected in series.

Namely, in either of JP '637 or Sakuraba, there is neither a description nor a suggestion of the structure of an oxide superconductor that is placed in the metallic electrode, so as to be substantially parallel with the interface between the metallic electrode and the mating conductor; the metallic electrodes and the mating conductors are disposed so as to be overlapped on each other; and the surface area of the overlapped part is larger than the sum of the sectional areas of the metallic electrodes and the sectional areas of the mating conductors, as recited in claim 7. Namely, JP '637 and Sakuraba neither have oxide superconductors nor have the structure of disposing the metallic electrodes and mating conductors so as to be overlapped on each other, and making the surface area of this overlapped part larger than the sum of the sectional areas of the metallic electrodes and the sectional areas of the mating conductors.

This makes the potential difference along the joint interface between the metallic electrodes and the mating conductors higher, when a large current such as 1000A is flown to the current lead. Since the potential difference along the joint interface between the metallic electrodes and the mating conductors becomes high, the current flows in a deviated manner to the part where the current easily flows in the interface between the metallic electrodes and the metallic conductors (drift current), and as a result, a resistance is generated.

As is clarified from the description above, all of the features recited in claim 7 are not easily derived from JP '637 and Sakuraba.

It is respectfully requested that the rejections be withdrawn.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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JAO:SMS/kxs

Attachments:
Petition for Extension of Time
Copy of first 2 pages of JP 2004-028470
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Date: December 6, 2006

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